Fluid Replacement and Heat Injury Prevention

FACTS

The potential for hot weather injuries for deployed personnel is approaching rapidly. From 2003 through 2004, 2676 heat injuries occurred among Soldiers, of which 526 were heat stroke and 2150 were heat exhaustion. Of these heat injuries 294 required hospitalization. The following information is provided to help reduce your risk of heat injuries.

Heat stress increases the sweating rate and therefore increases body water needs. If fluid is not fully replaced, then dehydration will occur. The myth that people can be taught to adjust to decrease water intake has been proven wrong many times.

Thirst does not adequately motivate personnel to promptly consume sufficient fluids to replace sweat losses in hot environments. Most fluid is replaced at mealtime; the food helps retain the consumed water in the body, not lost as urine.

MONITOR HYDRATION

Personnel can monitor hydration status by noting the color and volume of their urine and their body weight. Dark, low volume and infrequent urination indicates that fluid consumption should be increased. Likewise, frequent and large volumes of clear urine indicate that fluid replacement should be reduced (Note that it is possible to drink too much water…review the guidelines below for information applicable to conditions that may be encountered). Personnel can monitor their body weight before and after exercise (or upon awakening), as most weight loss will be from water. One quart of fluid equals about two pounds of weight.

ASSURE FULL HYDRATION

All personnel should assure full hydration before any work period during hot weather conditions. Drink sufficient water to replace the volume of sweat loss during work. Establish a drinking schedule and encourage and monitor drinking. To make water more palatable, cool it to 50 to 60 degrees F and add citrus fruit flavors or extracts for flavoring. Personnel should plan operations that include water supply points every three hours or less.

Personnel should ensure adequate time for meals is allowed and fluids are readily available. People usually drink most of their water with meals, and eating food improves water consumption. During mealtime, personnel can drink a variety of fluids (milk, juice, ice tea, sports drink) as each will be equally effective in replacing body water. In addition, meals provide the salt intake necessary to retain body water. Other beverages or fluids served in dining facilities are acceptable for fluid replacement; however, they should not be placed in canteens for use in the field for hygienic reasons.

Drinking is limited by how fast fluid is emptied from the stomach (average about 1.2 quarts per hour) and absorbed by the small intestine (this exceeds the gastric emptying rate). Dehydration

and intense exercise can reduce the gastric emptying rate. Since gastric emptying rates vary between personnel, each person needs to determine his or her own drinking pattern, based upon comfort.

ASSURE PROPER ELECTROLYTE REPLACEMENT

In addition to water, sodium, chloride and other electrolytes (potassium, calcium, and magnesium) are lost in sweat. Daily sodium consumption in dining facilities should provide adequate sodium replacement. If Meals Ready to Eat (MRE) are consumed, then personnel should consume their entire MRE ration, to include the salt package, during periods of strenuous physical work in the heat. Salt tablets are not recommended as their misuse has resulted in gastrointestinal discomfort and incapacitating nausea.

Sports drinks are an effective source for electrolyte replacement during prolonged (greater than 4 hours) periods of profuse sweating in hot weather. The type of carbohydrate does not matter (although high fructose should be avoided as it may cause gastrointestinal side effects). The primary concerns with sports drinks are their caloric density. If personnel drink 5 quarts of sports drinks that would constitute about 1600 kcal. Therefore, sports drinks should be used during conditions of prolonged physical work and not to totally replace water consumption.

HEAT INJURY SYMPTOMS/CATAGORIES/FIRST AID

Also see the following for a quick review of heat injury categories, symptoms, and first aid.

Comprehensive information about heat injury and prevention may be found at http://usachppm.apgea.army.mil/

FLUID REPLACEMENT GUIDELINES FOR WARM-WEATHER TRAINING

(Applies to Average Acclimated Soldier Wearing BDU, Hot-Weather)

		Easy Work		Moderate Work		Hard Work	
Heat Category	WBGT Index °F	Work/Rest*	Water Per Hour	Work/Rest*	Water Per Hour	Work/ Rest*	Water Per Hour
1	78-81.9	No limit	½ qt	No limit	¾ qt	40/20 min	¾ qt
2 (Green)	82-84.9	No limit	½ qt	50/10 min	¾ qt	30/30 min	1 qt
3 (Yellow)	85-87.9	No limit	¾ qt	40/20 min	¾ qt	30/30 min	1 qt
4 (Red)	88-89.9	No limit	¾ qt	30/30 min	¾ qt	20/40 min	1 qt
5 (Black)	>90	50/10 min	1 qt	20/40 min	1 qt	10/50 min	1 qt

** Rest means minimal physical activity (sitting or standing) and should be accomplished in the shade if possible.*

Note 1: The work/rest times and fluid replacement volumes will sustain performance and hydration for at least 4 hours of work in the specified heat category. Individual water needs will vary ± ¼ quart per hour.

Note 2: ***CAUTION: Hourly fluid intake should not exceed 1½ quarts. Daily fluid intake should not exceed 12 quarts.***

Note 3: Wearing MOPP gear or body armor adds 10°F to WBGT Index.

Examples:

Easy Work	Moderate Work	Hard Work
• Walking hard surface at 2.5 mph, <30-pound load • Weapons maintenance • Manual of arms • Marksmanship training • Drill and ceremony	• Walking hard surface at 3.5 mph, <40-pound load • Walking loose sand at 2.5 mph, no load • Calisthenics • Patrolling • Individual movement techniques; i.e., low crawl, high crawl • Defensive position construction • Field assaults	• Walking hard surface at 3.5 mph, >40-pound load • Walking loose sand at 2.5 mph with load

Note: Soldiers who are overweight, dieting, or past heat casualties are more prone to heat injuries. As a result, their activities must be closely monitored.

HEAT INJURY PREVENTION CHART

Hot-Weather Injuries

Sunburn

Cause
- Repeated exposures to hot environment (even on cloudy days)
- Depletion of body fluids.

Symptoms
- Skin is red and hot.
- Victim may experience headache or nausea.
- Blurred vision.

First-Aid
- Use sunscreen.
- Cover the body part that is being burned.
- Seek medical treatment if there is pain or blistering.

Heat cramps

Cause
- Heavy loss of salt through excessive sweating.
- Vomiting, diarrhea, or urination can make this, and all dehydration injuries, much worse.

Symptoms
- Painful muscle cramps.
- Pale, wet skin; dizziness; extreme thirst.

First-Aid
- Move the victim to shade and loosen clothing.
- Massage affected muscle.
- Frequent intake of water: a cup (8 oz) every 15-20 minutes, not to exceed 1½ quarts per hour.
- Thirst is not an adequate indicator of dehydration.
- If cramps persist, dissolve ¼ teaspoon table salt in one quart of water, and have the victim slowly drink at least one quart of the salt solution.

Heat exhaustion

Cause
- Prolonged exposure to hot conditions.
- Excessive salt depletion and dehydration.

Symptoms
- Profuse sweating, headache, tingling sensation in the extremities, weakness, loss of appetite, dizziness, nausea, cramps, chills, and rapid breathing.
- Skin is pale, cold, moist, and clammy. Victim might faint.

First-Aid
- Lay victim flat in a cool, shady spot.
- Elevate feet and loosen clothing.
- Pour water on victim and fan to cool.
- If conscious, have the victim drink at least one canteen full of cool water with the salt solution.
- If soldiers do not recover after an hour, evacuate to the nearest aid station or medical facility.
- It may be hard to distinguish between heat exhaustion and heat stroke, if in doubt, assume the worst and start treating the casualty as if it were heat stroke

Heat stroke

Cause
- Prolonged exposure to high temperatures and failure of the body's cooling mechanism (when the body's temperature rises rapidly, the sweating mechanism fails and the body is unable to cool down).

Symptoms
- Mental confusion or disorientation.
- Throbbing headache; flushed, dry skin; nausea; and elevated body temperature.
- Lack of sweating in the heat

First-Aid
- **This is the most serious hot weather injury! Heat stroke is a medical emergency and can lead to death! Get the soldier to a medical facility as soon as possible!**
- Start first-aid immediately. Move the victim to shade and cool with ice packs.
- If packs are not available, soak or douse victim with cool water. Do not immerse in ice water.
- Fan body and elevate feet.
- Do not try to give water to an unconscious victim.
- If medics or combat lifesavers are present, start intravenous (IV) fluids.
- Ensure cooling process is continued during transport to medical facility.

Comprehensive information about heat injury and prevention can be found at: http://usachppm.apgea.army.mil/heat/